Fermilab

DØ Experiment Department • MS357
Fermi National Accelerator Laboratory
P.O.Box 500 • Batavia, Illinois • 60510

(630) 840-4618

December 12, 2003

Fermilab Physics Advisory Committee
Professor James Alexander, Chair

Dear Colleagues,

We would like to update you on DØ's thinking concerning a possible increase in the rate of data that we write, and to request your input on our strategy.

The DØ B-physics program is making great progress. At Lepton-Photon 2003 we reported high B_s yields (~30 events per inverse picobarn) and very encouraging tagging power in the channels of interest. Unfortunately, the B-physics program is currently limited by our difficulty running the low-p_T triggers used for B-physics without prescales at high luminosities. In light of this, we (the spokespersons) asked the B-physics group convenors to investigate the physics gains derived from a doubling of our rate to tape (from roughly 50 Hz instantaneous to 100 Hz) with the increase entirely devoted to B-physics.

The gains from this doubling are significant, since they would essentially allow B physics (low p_T muon and J/psi) triggers to operate unprescaled at all luminosities. The B-physics group has prepared a white paper outlining the physics case (attached). Given our present operating conditions, the bandwidth upgrade would greatly enhance our reach for B_s mixing and may well be a defining factor for DØ's ability to compete in this important physics topic. Our detector has demonstrated significant capabilities in this area and we believe we should do all we can to exploit these capabilities, especially given the desire to get all the physics we can from the Tevatron.

We are not yet sure of our ability to store and process all the additional data resulting from expanding our data writing capability. The Run IIb upgrade project already includes the DAQ upgrades that are needed to increase the steady-state rate to 100 Hz. These hardware upgrades could be in place by summer 2004 at the soonest. The costs for storing and analyzing the increased data set would naturally fall within our computing budget and would at a minimum involve a doubling of the number of data tapes written per year and a doubling of tape drives. Since the Fermilab reconstruction farm is currently fully occupied, we would also need to roughly double the availability of reconstruction CPU's. This could be done at Fermilab or by expanding our already operational off-site reconstruction capabilities. There would also be an impact on the offline analysis facilities needed and, presumably, a need for additional Monte Carlo generation capability.

To set the scale for the costs that might be involved, we note that a doubling of the number of data tapes written would cost approximately $290k per year. An additional ten tape drives would cost about $300k; additional dCache and database servers would likely be required, at roughly $120k

total. The major impact would be the need to increase our primary processing and data analysis facilities. Using Fermilab costing, a doubling of these facilities would cost roughly $1.8M, but if we choose to pursue this upgrade, much of this will have to come from an increase in offsite capabilities.

We are excited about the physics that would be opened up by a rate-to-tape increase, but so far we do not fully understand the computing implications. Our current strategy is this:

- Continue to optimize the trigger strategy within the present DAQ capabilities, especially at Level 3 (which is the bottleneck for B-physics triggers).
- Continue to work to improve yields, understand tagging power, proper time resolution and so on.
- Work hard to reduce the reconstruction program speed (we have seen significant progress here recently) to minimize the computing resources needed.
- Develop and marshal offsite and overseas reconstruction resources. Here again we are making significant progress with three European sites now running the DØ reconstruction program on real data, but we have not yet amassed long-term experience on the event throughputs that can be sustained.

By spring 2004 we expect to have gained much more experience with large-scale offsite data processing and with reconstruction program speed at Fermilab. We will then be in a position to judge how much of the proposed increased "low-p_T" data rate could be handled by remote processing and how much locally. We will need to balance this option against other possibilities, such as using the reconstruction resources to routinely reprocess the "high-p_T" dataset. At that time, following proper discussion within the experiment, we would expect to come to an agreement with the laboratory on the best strategy to maximize B-physics from Run II and integrate this into our computing plan.

We would appreciate the PAC's input and guidance on the strategy outlined above.

Yours sincerely,

Gerald C Blazey

W. John Womersley

Jerry Blazey

John Womersley

Co-spokespersons, DØ Experiment